Section 3 Contents

3 Introduction

SECTION

UTAH STATE WATER PLAN - WEBER RIVER BASIN PLAN

River basin planning is the process by which policies and overall direction are given to wisely develop the limited water resources for future generations.

3.1 Background

The responsibility of comprehensive water planning has been legislated to the Division of Water Resources. As a result, the *Weber River Basin Plan* has been prepared under the direction of the Utah Board of Water Resources by division staff in close cooperation with a number of local, state, and federal agencies and individuals directly involved with water development and use.

Formulating a *State Water Plan* is an ongoing and dynamic process designed to address the changing nature of water development and use. Plans will be updated as needed. In areas (basins) of rapid change, plans could be updated as often as every five years. In areas where small changes occur, updates may be made at 10- or 15-year intervals.

State water plans establish and implement the basic framework of the state's water policy as it relates to the physical, environmental, economic and sociological aspects of water use within individual drainage basins. These aspects are described in the 19 sections of the *State Water Plan*.

3.2 Planning Guidelines

The *State Water Plan* and basin plans offer comprehensive assessments of current and projected water conditions. This basin plan provides the basis and background to assess the current and projected status of the basin's water resources.

3.2.1 Principles

The *Weber River Basin Plan* is based on a number of principles including:

- All waters, whether surface or subsurface, are held in trust by the state as public property, and their use is subject to rights administered by the State Engineer. The doctrine of prior appropriation has governed Utah water law since statehood.
- Water is essential to life. It is our responsibility to leave good quality water to meet the needs of the generations to follow.
- The diverse present and future interests of Utah's residents should be protected through a balance of economic, social, aesthetic and ecological values.
- Water uses for which beneficiaries are difficult to identify, such as recreation and aesthetics, should be included in program evaluations.
- Public input is vital to water resources planning.
- All residents of the state are encouraged to exercise water conservation and implement wise use practices.
- Water rights owners are entitled to transfer rights in free market conditions.
- Water resources projects should be technically, economically and environmentally sound.

- Water planning and management activities of local, state and federal agencies should be coordinated.

- Local governments, with state assistance as appropriate, are responsible for protecting against emergency events such as flood and droughts.

- Designated water uses and quality should be improved or maintained unless there is evidence the loss is outweighed by other benefits.

- Educating Utahns about water is essential. Effective planning and management requires a broad based citizen understanding of water's physical characteristics, potential uses and scarcity values.

3.2.2 Purpose

The main purpose of any basin water plan is to identify issues and describe alternatives to adequately provide for current and future water needs. Poorly conceived and irreversible commitments could be very costly and prevent the fulfillment of these needs.

3.2.3 Organization

State water planning is the responsibility of the Division of Water Resources under the auspices of the Board of Water Resources. Other state agencies with major water-related missions have been included in the development of the *Weber River Basin Plan.*

The coordinating committee represents 12 state agencies involved to various degrees in the regulation, development and planning of water resources in the state. This committee provides input to the basin planning process from a statewide perspective.

The steering committee consists of the chair and vice chair of the Board of Water Resources, executive director of the Department of Natural Resources, and director and assistant director of the Division of Water Resources. This committee provided policy guidance, resolved issues and approved this plan prior to acceptance by the Board of Water Resources.

Federal and other state agencies with some water-related objectives participated as cooperating entities. These agencies have particular expertise in various fields to assist with plan development. Also, a statewide local advisory group representing organizations and special interest groups has assisted with input and plan review. This group represents a spectrum of various interests and geographical locations.

The local Basin Planning Advisory Group for the Weber River Basin provided input by way of advice, review and decision making. Most of the members of this group reside within the basin or are directly involved in its affairs. They represent various local interests and provide geographical representation.

3.2.4 Process

The overall review process for the *Weber River Basin Plan* includes four drafts: the in-house, committee, advisory, and public review drafts. Upon completing all revisions associated with these documents, the final basin plan is made available to the general public as the *State Water Plan* for the Weber River Basin.

3.3 Basin Description

The Weber River Basin includes a significant share of the rugged Wasatch and Unita mountain ranges with peaks over 11,200 feet high. The total watershed area is estimated at 1.5 million acres of land within Weber, Davis, Morgan and Summit counties, excluding portions of the Great Salt Lake west of the 4200 foot shoreline elevation. The hydrologic boundaries of the basin are shown on Figure 3-1.

The basin has an average annual water supply of 979,400 acre-feet from surface water and groundwater sources. It also supports about 130,000 acres of irrigated agriculture, 420,000 people, and related municipal, commercial and industrial developments.

3.3.1 Drainage Area and Topography

The overall drainage area and related topography of the Weber River Basin consists of a transition from high mountain valleys with steep mountain ranges to flat spreading plains near the Great Salt Lake. The plains are more commonly known as the East Shore Area, which primarily consists of flat, fertile lake beds formed by alluvial deposits from ancient Lake Bonneville. Several terraced benches mark the different lake levels. The mouth of Weber Canyon is known as the Weber River Delta. The elevation varies from 4200 feet above mean sea level

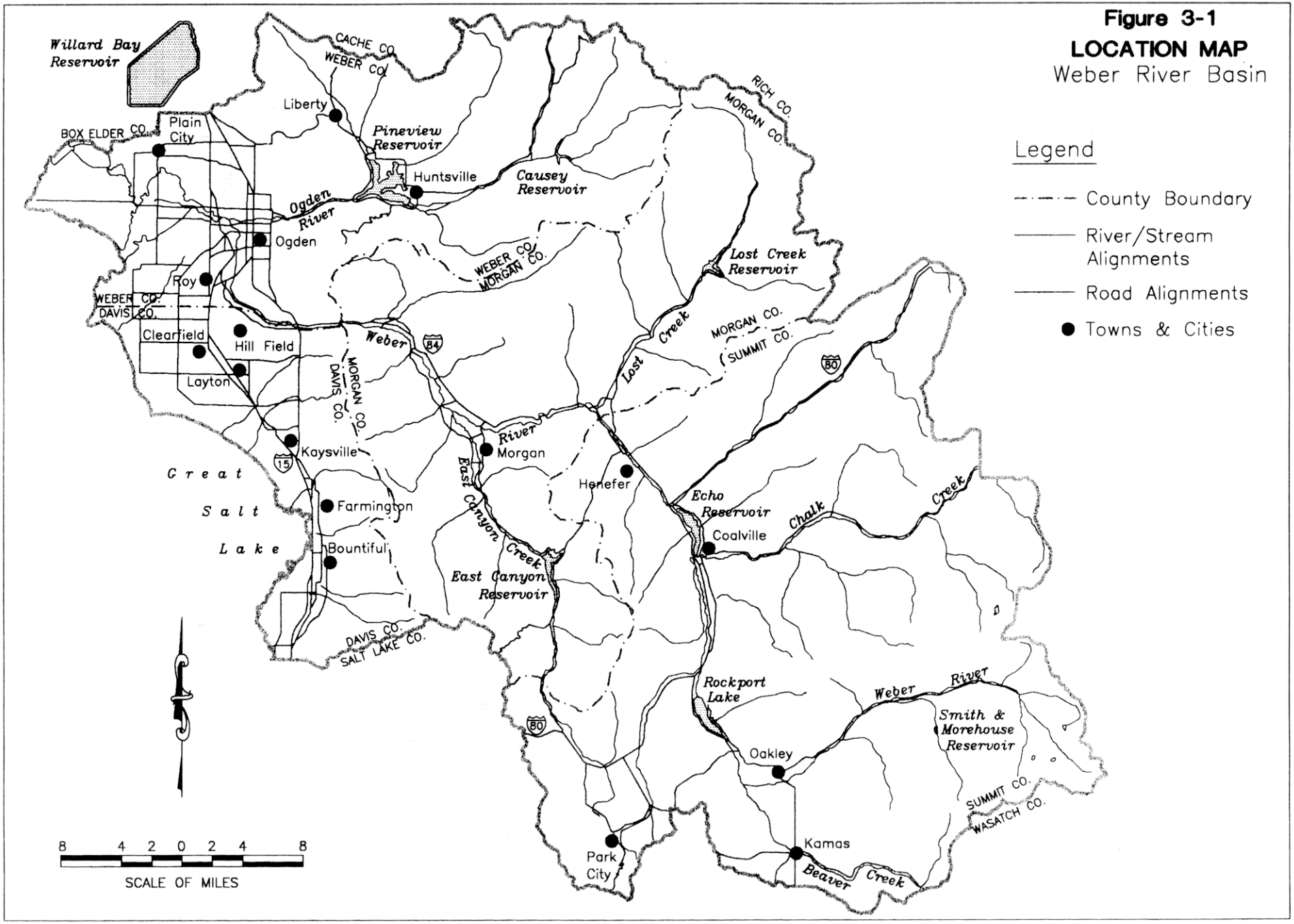


Figure 3-1
LOCATION MAP
Weber River Basin

at the Great Salt Lake to over 11,200 feet at a number of peaks within the Uinta Mountains.

The basin's mean elevation is 6700 feet. About 50 percent of the area ranges from 5900 feet to 7450 feet. Only 16 percent is less than 5000 feet. As a result, most of the upper basin consists of relatively high mountain valleys, mountain ranges and high bench areas with limited agricultural potential. The remaining 16 percent, or low-basin area, supports a fertile agricultural plain that has proven to be one of the largest producers of food and livestock in the state.

Rising abruptly from the valley floor of the East Shore Area, the rugged Wasatch Range runs in a north-south direction separating flat valley lands of the lower basin from the rolling hills and mountain valleys of the upper Weber and Ogden rivers drainages. The upper Weber River drainage in the Kamas and Oakley areas extends beyond local mountain valleys to the high peaks of the Uinta Mountains.

The major tributaries to the Weber River are Beaver Creek, Chalk Creek, Lost Creek, East Canyon Creek and the Ogden River. The largest is the Ogden River which joins the Weber River in the lower basin valley just prior to the point of discharge to the Great Salt Lake. The Ogden River drains what was once an arm of Lake Bonneville. The Ogden River drainage is now made up of three branches which traverse Ogden Valley and eventually discharge into Pineview Reservoir. The three branches of the Ogden River include the North, South and Middle forks.

From the basin divide in the Uinta Mountains to the Great Salt Lake, the Weber River drops from 11,200 feet to 4200 feet in 125 miles producing an average slope of 58.4 feet per mile. Within the East Shore Area, the slope averages 10 feet per mile. The relative steepness of the Weber and Ogden rivers generally produces high velocity flows during peak spring runoff periods.

3.3.2 Climate

The fluctuation of annual precipitation can be severe over an extended period of time as evidenced by the floods of the mid-1980s and the extended drought years of the late 1970s and early 1990s. Within the Weber River Basin, easterly migrating storm patterns encounter the 10,000-foot plus elevations of the Wasatch Range. The resulting effect is significant accumulations of precipitation in the high mountain watersheds. However, based on the general relationship of storm patterns to existing topography, precipitation is somewhat erratic and changes rather drastically from location to location. Annual precipitation ranges from 12 to 30 inches within 20 miles. The average annual precipitation is estimated at 21 inches.

Average annual temperatures in the Weber River drainage vary depending on elevation. In general, high mountain valleys are cooler and have shorter growing seasons than the lower East Shore Area. The upper mountain valleys, such as Ogden and Morgan, have an average growing season of nearly 95 days, while the growing season in the lower valleys west of the Wasatch Range is over 160 days. The average summer temperature is about six degrees cooler in the mountain valleys than at lower elevations west of the Wasatch Front. The cropping practices are, therefore, much different in the two areas. The mountain valleys are used primarily for forage crops and small grains, while the East Shore Area produces a wide variety of row crops, pasture grasses and a number of orchard crops. Mean annual temperatures for selected areas are summarized in Table 3-1.

3.3.3 Physiography and Geology

The Weber River Basin is composed principally of sedimentary deposits. The Paleozoic formations which form the basal complex consist chiefly of massive limestone, dolomite and shale with various mixtures of quartzite, sandstone and chert. The Mesozoic rocks are composed principally of sandstone, siltstone and shale. In the Wasatch Front region, there are some Pre-Cambrian deposits consisting mainly of metamorphosed rocks of schist, gneiss and quartzite. Some igneous rocks occur in the Park City area near the southern boundary of the drainage and extend westward into Little Cottonwood Canyon. These are later formations classed as Tertiary granitoid rocks.

The later Cenozoic formations (Tertiary and Quaternary) composing the mantle are generally weathered expressions of the basal unit. Because of this, these deposits do not generally occur as massive cemented rocks, but rather as broken fragments, porous conglomerates, or fine textured sands and gravels.

The principal tertiary deposit within the Weber River Basin is the Knight conglomerate which contains minor amounts of sand and silt. Extensive tuffaceous and limey beds of Tertiary deposits also occur there. The Quaternary formation consists chiefly of alluvial deposits along the stream beds, lacustrine deposits in the valley once occupied by Lake Bonneville and glacial deposits in the areas of highest elevation. The Quaternary deposits are generally fine textured sands, silts, clays and gravels.

Table 3-1
CLIMATOLOGICAL DATA FOR SELECTED BASIN WEATHER STATIONS

Weather Station	Average Mean Temp	Record Low Temp. (Degrees F)	Record High Temp	Normal Ann. Precip.	Record Month. Precip. (Inches)	Normal Ann. Snow	Record Month. Snow
Coalville	44.8	-33	99	16.42	6.13	73.0	78
Farmington	51.2	-14	102	22.73	7.94	52.1	41
Kamas	43.7	-31	100	18.00	9.22	86.7	84
Ogden	50.7	-26	106	16.84	5.62	25.0	47
Park City Summit	36.0	-17	80	26.98	8.49	316.3	103
Ogden Valley	43.7	-39	100	30.85	12.91	118.4	116
Riverdale	50.3	-25	104	19.94	6.95	29.0	44
Wanship	43.9	-37	98	16.61	6.18	63.8	53

Source: *Utah Climate*, Utah Climate Center, Utah State University; Logan, Utah, 1992.

In a broad sense, the absorptive nature of the mantle rock corresponds with its geologic age. In general, the older Precambrian, Paleozoic and Mesozoic rocks are the least permeable because of their massive, solid structure. The only source of water storage within these formations is in cracks and seams, along fault lines or other fractured areas, and in solution caverns. The most permeable are the Cenozoic group which includes the Quaternary alluvial and glacial deposits, and the older Tertiary deposits which are generally uncemented or unconsolidated.

The Weber River Basin contains undifferentiated geologic age groups. Those in the headwater areas of the Weber River contain extensive deposits of Quaternary glacial material. The highly permeable Quaternary material retains a considerable amount of water during high runoff. The retained water is eventually discharged later in the year and helps maintain base flows. The Quaternary material in the East shore Area supports all of the agricultural and most of the other cultural pursuits. Groundwater conditions also vary considerably in these formations.

3.3.4 Land Use

The area is diverse in terms of naturally occurring landscapes and land use practices. The high mountain areas are used extensively for a broad variety of outdoor recreational purposes and the production of agricultural crops, livestock and timber. The upper basin contains six ski resorts, seven major reservoirs, a matrix of cross-country hiking trails, and a number of streams utilized by sport fishermen, rafters and kayakers. Livestock production in the high mountain valleys is primarily limited to dairy and meat producing livestock, mink, and a few fish farms. Irrigated agriculture generally includes varieties of pasture grasses, alfalfa, small grains, some orchard crops and a variety of vegetables.

With the exception of the Snyderville Basin and Park City Area, populated areas in Summit County generally consist of small rural towns with small commercial businesses. The Snyderville Basin and Park City Area is one of the fastest growing in the state. The area primarily includes residential developments with a high percentage of the populace working in the Salt Lake Valley. The area supports major commercial and industrial concerns including ski resorts, tourism, a major manufacturer's outlet and a number of manufacturing businesses.

The lower Weber River area is a mixture of more populated towns and cities, farms and ranches, military installations, and a wide variety of commercial and industrial businesses.

The Ogden Valley area consists of three small rural communities with little or no commercial businesses outside of a few restaurants, convenience stores and three ski resorts. Pineview Reservoir is a recreational attraction for boating and outdoor camping enthusiasts.

Davis County has highly developed residential, commercial and industrial areas. Several cities have registered significant residential population growth rates in recent years. The northern part of the county supports a number of small family farms, while the southwestern part supports large industries including oil refineries and manufacturing facilities. Northeastern Davis County also supports municipal and residential developments with related small commercial businesses.

Agriculture is the largest single land use. This includes irrigated and dry cropland, rangeland and timber production.

3.3.5 Land Status

The Weber River Basin encompasses 1.5 million acres in Weber, Davis, Summit and Morgan counties. The federal government is responsible for administrating about 17 percent of the total land area. The state of Utah administers less than 1 percent. Eighty-three percent is in private ownership. The breakdown of land ownership and administration is shown in Tables 3-2 and 3-3.

3.3.6 Davis County

All of the drainages and related streams within Davis County are not directly tributary to the Weber and Ogden rivers, but a percentage of all water used in the county is diverted from the Weber River. In short, the county is highly dependant on water from the upper Weber River.

3.4 Water-Related History

The Weber and Ogden rivers have long been a source of water for various agricultural, municipal and commercial uses. Historically, the greatest demand has been for the irrigation of agricultural cropland on numerous small family farms and ranches. During early development from the mid-1800s to the turn of the century, annual flows of the Weber and Ogden rivers were more than sufficient to meet the needs of most agricultural interests. However, it became apparent a considerable percentage of the basin had exceptional soils and climate that could support irrigated agriculture on a much larger scale. As a result, the demand for additional irrigation water grew quite rapidly. By the late 1890s, local canal and irrigation companies were constructing reservoirs in the upper reaches of the Ogden and Weber rivers.

This started the era of large-scale water development projects within the Weber River Basin. The early water projects were initially pursued to provide supplemental water for irrigated agriculture. In subsequent years, multipurpose water projects were constructed to provide water for residential, commercial, recreational, industrial, agricultural and flood control purposes.

3.4.1 Early Pioneer Projects

Early pioneer projects generally included attempts to construct dams and conveyance systems for irrigated agricultural purposes. These projects were initiated by groups of small irrigation and canal companies whose demand for water eventually exceeded water supplies taken by direct river diversions. Of significance was the initial construction of East Canyon Dam by the Davis and Weber Counties Canal Company in 1894. Although the dam has been enlarged four times, the project was the first attempt by an organization of water users to construct a major water project. The initial East Canyon Reservoir had a total storage capacity of 3,800 acre-feet. Subsequent enlargements by the Bureau of Reclamation as part of the Weber Basin Project have provided a current active water storage capacity of 48,100 acre-feet.

3.4.2 Weber River Project

In addition to East Canyon Reservoir, the Weber River Water Users, in association with the Bureau of Reclamation, constructed Echo Reservoir in 1930 as the main feature of the Weber River Project. The primary goal was to provide supplemental water to the growing number of farms and ranches throughout the basin. The construction of Echo Reservoir has provided an additional active water storage capacity of 74,000 acre-feet.

Irrigation water stored in Echo Reservoir is used for agricultural crop production throughout the basin, including the drainage above the reservoir. Water used above the reservoir is considered exchange water or storage water that is exchanged for direct river diversions above the reservoir. Combined annual storage and direct diversions associated with Echo Reservoir provide the main source of water for more than 50 small irrigation companies in Morgan, Weber and Davis counties. The Weber River Water Users Association is the operation and maintenance agency for the Weber River Project.

The main features of the Weber River Project are shown on Figure 3-2.

3.4.3 Ogden River Project

The Ogden River Water Users Association was organized in 1933 to sponsor construction of the Ogden River Project. Project facilities impound and distribute

Table 3-2
SUMMARY OF LAND OWNERSHIP AND ADMINISTRATION

Status	County				Basin Total
	Weber	Davis	Morgan (acres)	Summit	
Private	267,900	92,400	344,700	509,100	1,214,100
State	1,300	na	3,800	4,500	36,800
Federal	84,100	48,600	11,800	104,600	249,100
Total	353,300	141,000	360,300	618,200	1,500,000

Table 3-3
FEDERAL LAND ADMINISTRATION

Agency	County				Basin Total
	Weber	Davis	Morgan (acres)	Summit	
Forest Service	76,400	39,200	10,100	99,700	225,400
Bureau of Land Management	100	300	600	1,200	2,200
Bureau of Reclamation	3,900	Neg	1,100	3,700	8,700
Department of Defense	3,700	9,100	0	0	12,800
Total	84,100	48,600	11,800	104,600	249,100

water from the Ogden River to farm and ranch lands within Weber and Box Elder counties. The project was substantially completed in 1937, and water began to flow in the South Ogden Highline and Ogden-Brigham City canals.

As shown on Figure 3-3, the major features of the project were the construction of Pineview Reservoir, a 75-inch diameter woodstave pipeline down Ogden Canyon, and two water delivery canals. One canal flows north servicing the North Ogden to Brigham City areas (Ogden-Brigham City Canal). The other flows south servicing the South Ogden area (South Ogden-Highline Canal).

Pineview Reservoir was enlarged in 1957 from an initial capacity of 44,175 acre-feet to 110,200 acre-feet as part of the Weber Basin Project. A woodstave pipeline was recently replaced with funding provided by the Bureau of Reclamation. Current average annual deliveries from project facilities have been estimated at over 38,600 acre-feet.

3.4.4 Weber Basin Project

The multipurpose Weber Basin Project service area extends into Box Elder, Davis, Morgan, Summit and Weber counties. The original project, completed in 1969, was constructed by the Bureau of Reclamation with the primary objectives of: 1) Developing all the water resources to the fullest extent possible in the four county area, and 2) enhancing the operation of existing projects through the enlargement of existing storage facilities and by constructing new storage and distribution systems. The project is managed by the Weber Basin Water Conservancy District.

Current annual deliveries from the Weber Basin Project are in excess of 200,000 acre-feet to various municipal, industrial and agricultural water users within the 86,000-acre service area.

In addition, the initial project incorporated a number of features to provide flood control and

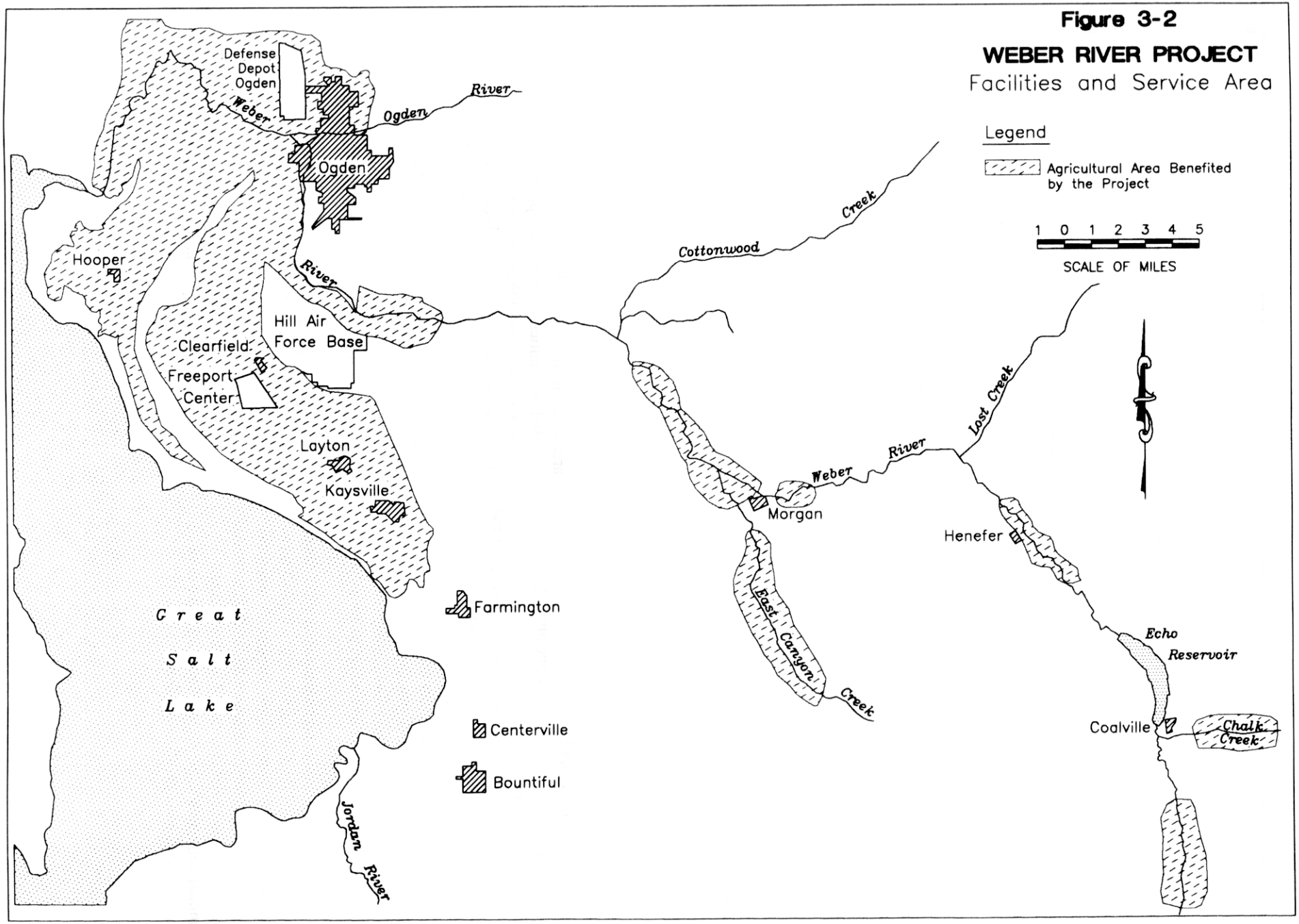
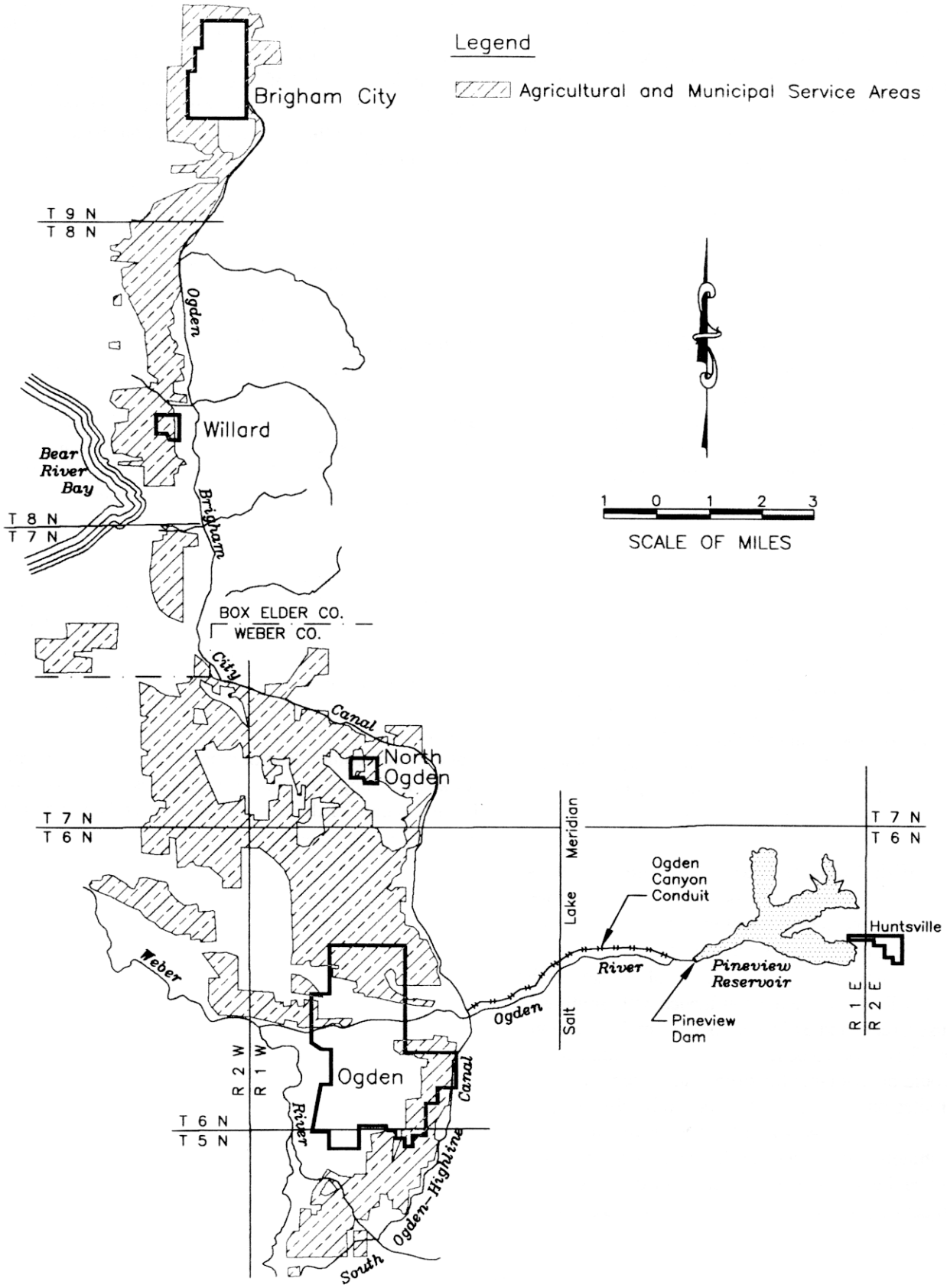


Figure 3-2
WEBER RIVER PROJECT
Facilities and Service Area
Legend
Agricultural Area Benefited by the Project
1 0 1 2 3 4 5
SCALE OF MILES
Defense Depot Ogden
Weber River
Ogden River
Ogden
Hooper
Hill Air Force Base
Clearfield
Freeport Center
Layton
Kaysville
Great Salt Lake
Farmington
Centerville
Bountiful
Jordan River
Cottonwood Creek
Lost Creek
Weber River
Morgan
Henefer
East Canyon Creek
Echo Reservoir
Coalville
Chalk Creek

Figure 3-3

OGDEN RIVER PROJECT

Facilities & Service Area



recreational opportunities at major project facilities. These features include provisions to maintain adequate fish and wildlife habitat through the establishment of minimum instream flows for the Ogden and Weber rivers. The largest wildlife habitat areas include the Harold S. Crane, Howard Slough and Ogden Bay wildlife management areas. The Weber Basin Project included six major reservoirs with a combined active storage capacity of over 444,900 acre-feet of active storage, 120 miles of distribution canals, 140 miles of distribution laterals, 11 pumping plants, nine domestic wells, and four culinary water treatment plants (one operated by Ogden City) with a combined capacity of over 117 cubic feet per second.

Major facilities added to the project since its initial construction include Smith and Morehouse Dam and Reservoir; several deep wells for municipal, industrial and agricultural water uses; a major expansion to the Layton and Ogden culinary water treatment facilities; and major revisions to the Gateway Canal and Tunnel to mitigate escalating canal seepage and slope instability, primarily in Morgan County. The entire project, including its major facilities and service area, is shown on Figure 3-4.

3.4.5 Small Canal, Ditch and Water Companies

Water is also supplied to farms, ranches, cities, towns, and commercial and industrial businesses by over 230 small water provider organizations typically described as canal, ditch or water companies. These smaller organizations obtain water supplies from a variety of sources including larger water districts and water user associations, wells, and small surface diversions from existing streams and rivers.

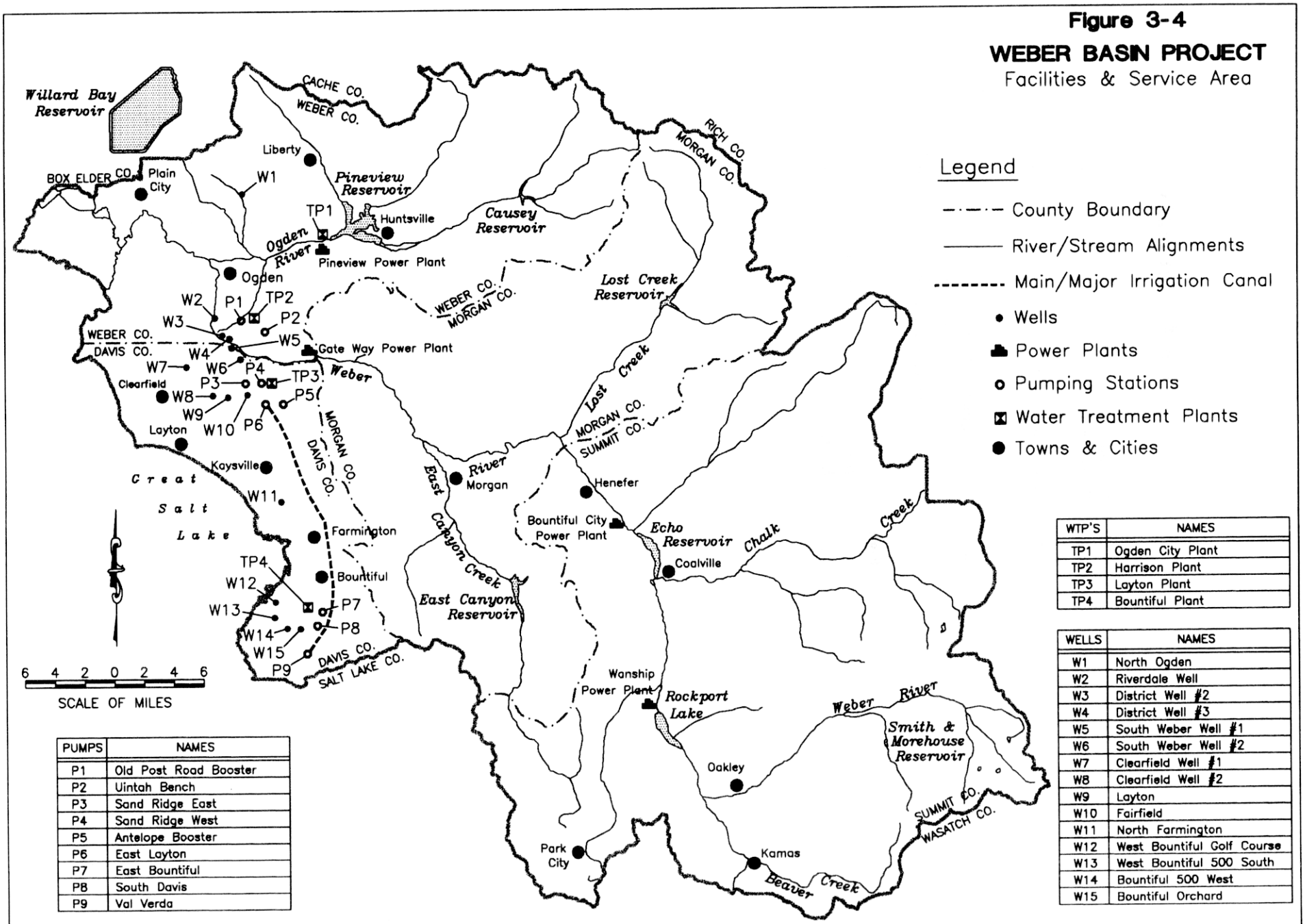
3.4.6 Possible Surface Water Storage Facilities

Three reservoirs sites have been studied as possible future water storage development projects. These sites include 1) Magpie Dam on the South Fork of the Ogden River above Pineview Reservoir, 2) Larrabee Dam on the upper Weber River above the confluence with Smith and Morehouse Creek, and 3) Davis Pond, a smaller version of Willard Reservoir to be located in Farmington Bay. Water would be available for storage at these new reservoir sites only in very wet years. To be effective, they would require large volumes of holdover storage. The unavailability of a dependable water supply for these reservoirs, and with the available developed storage already meeting present and near future projected needs, it is unlikely any of these potential reservoirs will be built.

Diking of portions of the Great Salt Lake to create fresh water reservoirs for a water supply to the Wasatch Front Area has been proposed. Lake Wasatch would be created by diking from the south shore of the Great Salt Lake to the south end of Antelope Island, from the north end of Antelope Island to the south end of Fremont Island, and from the north end of Fremont Island to Promontory Point. Water from the Bear, Weber and Jordan rivers would flow into Lake Wasatch.

Davis Lake, also called Bonneville Bay, would be created by diking from the south shore of the Great Salt Lake to the south end of Antelope Island, and from the north end of Antelope Island to Syracuse along the present Syracuse Causeway. The major inflow to the proposed Davis Lake would be the Jordan River.

Lake Wasatch and Davis Lake were investigated in the mid-1980s as Great Salt Lake flood control alternatives along with Bear River water development and the West Desert Pumping Project. The Great Salt Lake Development Authority was created by the Utah Legislature in 1989 to further study the feasibility of Lake Wasatch. After a year and a half of study and public hearings, the Great Salt Lake Development Authority reported Lake Wasatch did not appear to be economically or environmentally feasible and did not merit further consideration. But the Great Salt Lake Development Authority recommended further study and evaluation to determine if the proposed Davis Lake could be used for recreation and/or water storage. Studies have shown the water in the proposed Davis Lake would require desalting before it would be useable for a water supply project. Some interest still exists in Davis County for the Davis Lake Project for recreation and land development. ❖



PUMPS	NAMES
P1	Old Post Road Booster
P2	Uintah Bench
P3	Sand Ridge East
P4	Sand Ridge West
P5	Antelope Booster
P6	East Layton
P7	East Bountiful
P8	South Davis
P9	Val Verda

WTP'S	NAMES
TP1	Ogden City Plant
TP2	Harrison Plant
TP3	Layton Plant
TP4	Bountiful Plant

WELLS	NAMES
W1	North Ogden
W2	Riverdale Well
W3	District Well #2
W4	District Well #3
W5	South Weber Well #1
W6	South Weber Well #2
W7	Clearfield Well #1
W8	Clearfield Well #2
W9	Layton
W10	Fairfield
W11	North Farmington
W12	West Bountiful Golf Course
W13	West Bountiful 500 South
W14	Bountiful 500 West
W15	Bountiful Orchard